THE IMPACT OF REALIZED ACCESS TO CARE ON HEALTH-RELATED QUALITY OF LIFE: A TWO-YEAR PROSPECTIVE COHORT STUDY OF CHILDREN IN THE CALIFORNIA STATE CHILDREN'S HEALTH INSURANCE PROGRAM

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Objective To examine the effect of realized access to care (problems getting care, access to needed care) on health-related quality of life (HRQOL) in the California State Children's Health Insurance Program.

Study design This was a prospective cohort study (n = 4,925; 70.5% [3438] had complete data). Surveys were taken at enrollment and after 1 and 2 years in the program. Parents and children reported HRQOL (PedsQL™ 4.0 Generic Core Scales). Repeated-measures analysis accounted for within-person correlation and adjusted for baseline PedsQL™, baseline realized access, race/ethnicity, language, chronic health condition, and having a regular physician.

Results Realized access to care during the prior year was related to HRQOL for each subsequent year. Foregone care and problems getting care were associated with decrements of 3.5 ($P < .001$) and 4.5 ($P < .001$) points for parent proxy-report PedsQL™ and with decrements of 3.2 ($P < .001$) and 4.4 ($P < .001$) points for child self-report PedsQL™. Improved realized access resulted in higher PedsQL™ scores, continued realized access resulted in sustained PedsQL™ scores, and foregone care resulted in cumulative declines in PedsQL™ scores.

Conclusions Realized access to care is associated with statistically significant and clinically meaningful changes in HRQOL in children enrolled in the California State Children's Health Insurance Program. *(J Pediatr 2006;149:354-61)*

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The State Children's Health Insurance Program (SCHIP), the largest expansion of spending for children's healthcare since Medicaid, is slated for reauthorization in 2007. These programs have been shown to improve access to care,[1-7] and particularly realized access (receiving needed care),[8] which is universally recognized as critically important. However, little evidence yet exists linking realized access to health outcomes such as health-related quality of life (HRQOL). This gap is particularly noteworthy, given recognition that HRQOL is an important health outcome in child health services research.[9-11] The present study bridges this gap by examining the effect of realized access on HRQOL in an SCHIP sample.

HRQOL refers to that aspect of quality of life directly related to an individual's health,[12] including physical, mental, and social well-being.[13] Given the subjective nature of HRQOL, it should be assessed, whenever possible, from the individual's perspective.[14,15] Parent proxy-reports of HRQOL are also important, however, as both parent[16] and child[17] reports are related to health care utilization. Great strides have been made in conceptualizing and measuring HRQOL for children[14,15,18-25] and researchers have reported on the feasibility, reliability, and validity of HRQOL as a population health measure.[25-27]

To date, studies of the impact of access to care on children's health outcomes in SCHIP populations are inconclusive. Damiano et al[28] showed that enrollment in Iowa's SCHIP program improved parent ratings of child health, but Szilagyi[3] et al found no change in parental ratings in a study of New York state's SCHIP program. Neither study examined the link between realized access and health outcomes and both used a single-

HF	Healthy Families, California's SCHIP program	SCHIP	State Children's Health Insurance Program
HRQOL	Health-related quality of life		

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item parent proxy-report health measure rather than a more comprehensive, multidimensional HRQOL measure using both parent proxy-report and child self-report.

Evidence regarding the effect of realized access to care on subsequent HRQOL would be important in several respects. First, it would allow an assessment of the effect of programs shown to improve access to care, such as SCHIP, on children's health outcomes. Second, measuring HRQOL from the parent and child perspective would assess these programs' impact from the perspectives of the actual consumers of care. Third, evidence regarding the effect of realized access on HRQOL would provide impetus for public policy to improve realized access to care, not just potential access.

We report on the link between realized access—here operationalized in terms of parent reports of foregone care and problems getting care—and HRQOL in a 2-year, prospective cohort study of enrollees in Healthy Families (HF), California's SCHIP program. Based on prospective data showing an effect of Iowa's SCHIP on children's health status[28] and studies in adults showing an effect of health insurance coverage on adult HRQOL using the SF-36,[29] we hypothesized that foregone care and problems getting care would be prospectively related to HRQOL, after controlling for baseline HRQOL, baseline realized access, demographics and chronic health condition status, and whether the child had a regular physician.

METHODS

As part of California Insurance Code 12693.92(b), requiring the State's Managed Risk Medical Insurance Board to report on changes in health status of HF enrollees over time, the State of California conducted a 3-year survey in 2001 to 2003. Families were surveyed at HF enrollment and at 1 and 2 years after enrollment. The PedsQL™ 4.0 survey was mailed to the 20,031 families throughout California who were English-, Spanish-, Vietnamese-, Korean-, or Cantonese-speaking, who enrolled in HF during February and March 2001, and whose children were ages 2 to 16 years. Although the PedsQL™ 4.0 can be administered for children ages 2 to 18, children older than 16 years of age were not enrolled in this prospective study because they would have been older than 18 at the 2-year follow-up.

Sample

One child per family was included in the sampling. For families with more than one child enrolled, the target child was first in alphabetical order by given name. We characterize the response rate in three ways: (1) by comparing the number of survey responses to the number of families enrolled in HF at baseline (absolute response rate), (2) by comparing the number of survey responses to the number of families who responded to the baseline survey and were still enrolled in HF at subsequent years (eligible response rate), and (3) by comparing the number of survey responses to the number of families enrolled at all three time points (the effective response rate). For the absolute response rate, of the 20,031 families in the original sample, 10,241 families (51%) responded at baseline, 6005 families (30%), at year 1, and 3738 families (18.6%), at year 2. However, this does not take into account disenrollment in HF over time. The eligible response rate takes disenrollment into account. At year 1 follow-up, 6881 of the 10,241 families surveyed at baseline (67.2%) were still enrolled in HF, with 87.3% (n = 6005) of these responding. At year 2, 4952 families (48.4% of the original sample, 72% of the year 1 sample) were still enrolled, with 75.5% (n = 3738) of these responding. For this analysis, we included families who responded to all three surveys (n = 3489). Thus, the effective response rate (respondents to all three surveys divided by enrollees enrolled at all three time points) was 3489 of 4952, or 70.5%.

Measures

Health-Related Quality Of Life: The Pedsql™ 4.0 Generic Core Scales. The PedsQL™ 4.0 (Pediatric Quality of Life Inventory™ Version 4.0; www.pedsql.org)[15,18,26] is a 23-item measure of pediatric HRQOL, composed of parallel child self-report and parent proxy-report formats. The recall period for the PedsQL™ 4.0 is the past 1 month. Children as young as 5 to 7 years old produce reliable and valid data using the self-report version of the PedsQL™.[18,26] The PedsQL™ is scored on a 0 to 100 scale, with higher scores indicating better HRQOL.

Realized Access to Care: Realized access was measured through parents' reports of problems getting necessary care ("In the last 12 months, how much of a problem, if any, was it to get care for your child that you or a doctor believed necessary?" Response options: No problem/A small problem/A big problem; dichotomized into problem/no problem),[30] and foregone care[31] ("In the past 12 months, has there been any time when you thought your child should get medical care, but did not?" Response options: Yes/No).

Family and Child Characteristics: Child race/ethnicity (Latino, Asian/Pacific Islander, African-American, white, Native American, Not Reported) and preferred parental language (recoded into English or other) were linked from the families' original HF enrollment applications. Parents reported on whether the child had a chronic health condition, defined as a physical or mental health condition that has lasted or is expected to last at least 6 months and interferes with the child's activities.

Procedure

DataStat, Inc, a nationally recognized survey firm, mailed the survey with a cover letter specifying the target child and providing instructions. Parents and children were instructed to complete the survey separately, except for children ages 5 to 7, who were assisted by their parents after the parent completed the proxy-report. A reminder postcard followed the initial mailing, with a second survey mailed to

Table I. Sample characteristics of survey respondents at each year

Characteristic	Baseline n = 10,241	Year 1 n = 6005	Year 2 n = 3738	All years n = 3489
	%	%	%	%
Sex				
Female	47.93	47.09	47.22	47.00
Language				
English*	42.95	39.40	36.06	35.14
Spanish	50.71	53.79	55.51	56.72
Vietnamese	1.42	1.37	1.52	1.46
Korean	1.67	1.73	1.90	1.89
Chinese	3.25	3.71	5.00	4.79
Race/ethnicity				
White*	13.74	12.69	11.24	10.89
Latino	61.51	62.60	62.25	63.00
Black*	2.34	1.93	1.79	1.66
Asian/Pacific Islander	11.76	12.46	13.96	13.79
Native American	0.40	0.40	0.51	0.54
Not reported	10.25	9.93	10.25	10.12
Chronic health condition				
Yes	8.75	8.50	7.69	7.75
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Parent proxy-report PedsQL™	81.3 (15.9)	82.0 (15.3)	81.1 (15.7)	81.1 (15.7)
Child self-report PedsQL™	82.9 (13.2)	82.9 (13.6)	84.0 (12.8)	84.0 (12.8)

*Less likely to complete survey at year 2 ($P < .0001$).

nonrespondents.[32] At year 1 only, nonrespondents to the second survey received a telephone reminder.

To ensure the anonymity (to the researchers) of the responses, surveys were returned to DataStat, who matched survey responses to demographics, stripped identifiers, and delivered an analysis file to the researchers. Since this survey was conceived of as an operational requirement and was conducted to comply with California Insurance Code 12693.92(b), parents and children did not complete informed consent forms. The research protocol of analyzing existing de-identified data was approved by the Institutional Review Board at Children's Hospital and Health Center, San Diego, where the first two authors worked at the time of the study.

Statistical Analysis

We described the sample over time by sex, language, race/ethnicity, chronic health condition status, and PedsQL™ scores (Table I). For descriptive purposes, we compared realized access to care (defined as no foregone care, no problems getting care) over time and by race/ethnicity and language (Table II). To assess how realized access affects HRQOL, we regressed HRQOL on foregone care and problems getting care, indicator variables for race/ethnicity, an indicator of whether the preferred parental language was English, presence of chronic health conditions, and whether the child had a regular doctor. HRQOL and realized access are measured for each of 3 years (Table III).

We created a longitudinal data set, with each observation indexed by subject and time. Because this is a longitudinal data set with repeated measures on subjects over time, the analysis must take within-subject correlation into account. We used a repeated-measures analysis to account for within subject correlation rather than ordinary least-squares regression. In this way, we could model HRQOL on foregone care and other variables, including demographic variables, taking into account the within-subject correlation structure that changes over time. Specifically, we used generalized estimating equations for estimation and assumed a gaussian distribution for HRQOL and an unstructured correlation structure. We computed robust standard errors from within-subject residuals, which leads to valid inferences in large samples even if the working correlation structure were specified incorrectly. Moreover, the generalized estimating equations approach will tend to work best with a relatively large number of subjects. The 3489 subjects in the study is considered a very large number in this context.[33] We display the unstandardized regression coefficients (and statistical significance) of the variables of interest predicting parent proxy-report and child self-report PedsQL™ scores.

To display the relation between realized access to care and PedsQL™ scores over time, we plotted the unadjusted mean PedsQL™ scores for parent proxy-report (Figure 1) and child self-report (Figure 2) by foregone care over time. We plotted the overall mean PedsQL™ score for

Table II. Percentage of sample reporting no foregone care and no problems getting care over time, overall and by race/ethnicity and language

	No foregone care			No problems getting care		
	Baseline	Year 1	Year 2	Baseline	Year 1	Year 2
Overall	84.2	91.3	92.6	80.5	83.7	84.1
Race/ethnicity						
White	87.3	91.5	94.3	88.7	87.9	87.8
Latino	84.1	91.7	92.1	81.3	84.8	85.0
Black	82.5	94.8	93.0	78.9	84.5	87.7
Asian/Pacific Islander	83.5	89.0	93.4	75.6	77.4	77.2
Language						
English	84.9	91.7	93.5	81.8	83.9	84.9
Spanish	83.6	91.2	91.8	80.1	84.7	84.9
Vietnamese	78.4	90.2	93.8	62.0	61.2	63.0
Korean	87.5	92.1	92.3	86.2	75.0	80.0
Chinese	86.7	89.2	95.6	79.6	79.9	74.8

Table III. Repeated-measures regression analysis: Parent proxy-report and child self-report PedsQL™

	Parent proxy-report		Child self-report	
Variable	Coefficient	*P*	Coefficient	*P*
Reports foregone care	−3.484	.001	−3.243	.001
Reports problems getting care	−4.479	.001	−4.399	.001
Hispanic (reference: white/non-Hispanic)	0.533	.344	0.467	.405
Asian/Pacific Islander (reference: white/non-Hispanic)	2.425	.001	3.671	.001
Survey not in English	−3.411	.001	−1.137	.021
Child has a regular doctor	0.599	.197	−0.39	.366
Chronic health condition	−6.16	.001	−6.368	.001
Constant	84.053	.001	85.395	.001

The coefficient indicates the adjusted mean change in PedsQL™ score associated with each variable.

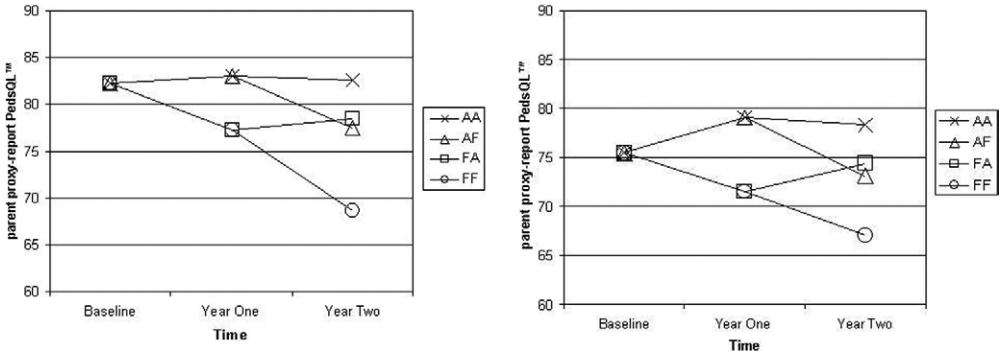

Figure 1. Health-Related Quality of Life (parent proxy-report PedsQL™ 4.0 scores) at baseline, year 1, and year 2, by access groups, for those reporting access to needed care **(a)** or foregone care **(b)** at baseline. *PedsQL™*, Pediatric Quality of Life Inventory™ 4.0; scores are from 0 to 100, with 100 being best. Access group labels: *AA,* access to needed care (no foregone care) in both years; *FF,* foregone care in both years; *AF,* access in year 1, foregone care in year 2; *FA,* foregone care in year 1, access in year 2.

baseline, then the year 1 PedsQL™ scores based on foregone care at year 1, then the year 2 PedsQL™ scores based on foregone care at year 2. We did this separately for those reporting no foregone care (Figures 1a and 2a) and foregone care (Figures 1b and 2b) in the year before enrollment. Given the small number of Native Americans (n = 15) in the sample, these respondents were dropped from analyses that included race/ethnicity. All analyses except the repeated-measures analysis used SPSS Version 11.5.1. The repeated-measures analysis used Stata 9.

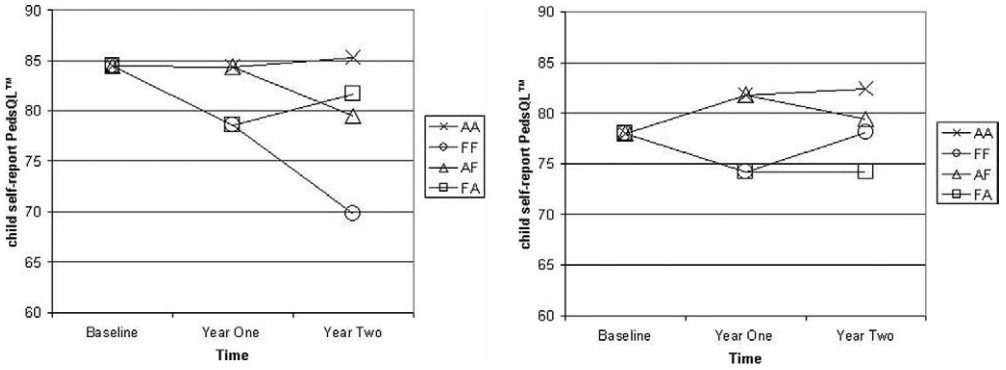

Figure 2. Health-Related Quality of Life (child self-report PedsQL™ 4.0 scores) at baseline, year 1, and year 2, by access groups, for those reporting access to needed care **(a)** or foregone care **(b)** at baseline. *PedsQL™,* Pediatric Quality of Life Inventory™ 4.0; scores are from 0 to 100, with 100 being best. Access group labels: *AA,* access to needed care (no foregone care) in both years; *FF,* foregone care in both years; *AF,* access in year 1, foregone care in year 2; *FA,* foregone care in year 1, access in year 2.

RESULTS

Sample Characteristics

There were 3452 year 2 completed parent proxy-report and 2729 year 2 completed child self-report PedsQL™ measures available for analysis. Table I summarizes the sample characteristics at each year and for those with completed surveys at all 3 years. Our sample was very diverse, both in terms of race/ethnicity and language. Whites and African-Americans were less likely to have completed surveys at all 3 years ($\chi^2[3] = 62.16$, $P < .0001$), as were English speakers ($\chi^2[4] = 152.97$, $P < .0001$). We examined enrollment status by baseline PedsQL™ score to determine if sicker children were more or less likely to drop out of SCHIP. χ^2 analyses comparing baseline PedsQL™ quartile to enrollment status at the end of years 1 and 2, found no relation between the two (for year 1 enrollment status, $\chi^2[3] = 3.28$, $P = .35$; for year 2 enrollment status, $\chi^2[3] = 3.1$, $P = .38$). Similarly, we examined respondent status by PedsQL™ quartile and determined that child health was not related to survey participation (for baseline PedsQL™ quartile by year 1 respondent, $\chi^2[3] = 1.9$, $P = .59$; for year 1 PedsQL™ quartile by year 2 respondent, $\chi^2[3] = 7.3$, $P = .062$).

Access to Care

The proportions of parents reporting no foregone care and no problems getting care at baseline and years 1 and 2, overall and by race/ethnicity and language are displayed (Table II). For the sample overall, the proportion of respondents reporting no foregone care increased from baseline to year 1 (84.2% vs 91.3%; Wilcoxon signed ranks test, $Z = -9.9$, $P < .001$) and then again from year 1 to year 2 (91.3% vs 92.6%; Wilcoxon signed-ranks test, $Z = -2.4$, $P < 0.016$). Year 2 rates of foregone care were not different by race/ethnicity ($\chi^2[4] = 2.95$, $P = .71$), nor by language ($\chi^2[5] = 5.47$, $P = .24$). For no problems getting care, the proportion of the sample overall reporting no problems increased from baseline to year 1 (80.5% vs 83.7%; Wilcoxon signed-ranks test, $Z = -4.1$, $P < .001$) but not from year 1 to year 2 (83.7% vs 84.1%; Wilcoxon signed-ranks test, $Z = -0.12$, $P = .91$). At year 2, Asian/Pacific Islanders were more likely to report problems getting care ($\chi^2[4] = 22.4$, $P < .001$), as were Vietnamese and Chinese speakers ($\chi^2[5] = 28.3$, $P < .001$) compared with those in other categories.

Realized Access and PedsQL™ scores

Table III gives the results of the repeated-measures analysis. Foregone care in the past 12 months, problems getting care in the past 12 months, having a survey in a language other than English, and chronic health conditions significantly reduce parent proxy-report PedsQL™ scores by 3.5, 4.5, 3.4, and 6.2 points, respectively (all values significant at $P < .001$). Foregone care in the past 12 months, problems getting care in the past 12 months, and chronic health conditions significantly reduce child self-report PedsQL™ by 3.2, 4.4, and 6.4 points, respectively (all values significant at $P < .001$). Asians/Pacific Islanders have a significantly higher PedsQL™ scores (2.4 points for parent proxy-report and 3.7 points for child self-report).

Unadjusted mean PedsQL™ scores by parent proxy-report (Figure 1) and child self-report (Figure 2) are shown for each of the four groups over time for those reporting access to needed care (Figures 1a and 2a) or foregone care (Figures 1b and 2b) at baseline. By parent proxy-report, for those reporting access to needed care before enrollment, continuing access was associated with a maintenance in PedsQL™ scores, whereas foregone care was associated, in a cumulative manner, with declining PedsQL™ scores. For those reporting foregone care before enrollment in SCHIP, improved access was associated with higher PedsQL™ scores, whereas continuing poor access was associated, in a cumulative manner, with declining HRQOL. By child self-report, the pattern was similar, with the exception of those whose parents reported foregone care for baseline and in both years

of enrollment: their PedsQL™ scores increased from year 1 to year 2.

DISCUSSION

We prospectively demonstrated the effect of realized access to care on HRQOL in a sample of SCHIP enrollees. We found, as have others,[4-7] that realized access to care increased over time for SCHIP enrollees. In this study, overall rates of foregone care decreased substantially—by more than half—and rates of problems getting care decreased significantly. Further, rates of foregone care decreased across all race/ethnicity and language categories and rates of problems getting care decreased for Latinos and blacks and for English- and Spanish-speakers such that, with the exception of Asian/Pacific Islanders and Asian-language speakers, there was a substantial elimination of disparities by year 2.

The key contribution of this study, however, is demonstrating the prospective link between realized access to care and children's HRQOL, even after adjusting for child and family characteristics (race/ethnicity, language, chronic health condition status) and whether the child had a regular provider. The link between realized access to care and HRQOL was made visually explicit by plotting PedsQL™ scores by realized access over time. For those who report foregone care before SCHIP enrollment, getting care when needed is associated with increases in PedsQL™ scores, and for those with access to care before enrollment, continuing access to needed care is associated with continued health. On the other hand, irrespective of foregone care before enrollment, foregone care over time is associated with a cumulative decrease in HRQOL scores.

The difference in adjusted PedsQL™ scores associated with realized access to care is clinically meaningful as well. Experiencing foregone care and problems getting care, together, corresponds to an 8-point drop in parent proxy-report PedsQL™ scores and a 7.6-point drop in child self-report PedsQL™ scores. These values are larger than the PedsQL™ minimally clinical important difference of 4.5 points.[26] The minimally clinical important difference is the smallest difference in a score that patients perceive to be beneficial and that would mandate, in the absence of troublesome side effects and excessive costs, a change in the patient's management.[34] To place these PedsQL™ scores into clinical perspective, parent-report PedsQL™ scores for children with foregone care at both year 1 and year 2 are similar to those of newly diagnosed pediatric cancer patients receiving treatment.[35]

Study limitations include that the sample is restricted to those with surveys at all three times. This might have introduced systematic bias, as whites, African-Americans, and English-speakers were less likely to be included. Although PedsQL™ scores were not related to continuing SCHIP enrollment, nor whether a family responded to a subsequent survey—suggesting that HRQOL was not related to enrollment or retention in the sample—such selection bias is difficult to rule out unequivocally. Similarly, bias may have been introduced by the fact that the absolute response rate was relatively low. Families who declined to respond to the baseline survey, or who disenrolled from HF over time, might be systematically different from families who did not on some unmeasured variable. In terms of measurement, those without foregone care or problems getting care include those who needed care and received it, as well as perhaps those who did not need care. Also, the relation between realized access and HRQOL may be more complicated than is portrayed here. Not only might HRQOL decline if needed access to care is not realized, but an independent deterioration in health can lead to an increase in reporting of foregone care or problems getting care because it is when one is sick that care is most perceived as needed. Further research is necessary to disentangle these two factors and to compare those needing care who did and did not receive it, excluding those in the comparison group who did not need care in the first place. Finally, we did not measure the quality of the care received—another clearly important factor.

This study has several implications for health policy. First, given poor and minority children's much greater likelihood of experiencing unmet need for care[36,37] and the deleterious effect of foregone care and problems getting care on HRQOL, SCHIP and similar programs might be vehicles for reducing health disparities. In California, a new campaign, Californians for Healthy Kids, has been launched by a consortium of child health experts, advocacy groups, and legislators to promote legislation to ensure health insurance for all children across the state (regardless of family income or immigration status). The campaign builds, in part, on existing county health insurance programs modeled after SCHIP (but with broader eligibility criteria) to expand this model statewide. The results of this study provide some empirical support for this policy direction, suggesting that enrollees in SCHIP and SCHIP-like programs should experience fewer instances of unmet need than they would otherwise, with concomitant improvements in health outcomes.

Second, despite the decrease in foregone care, our data show that even with health insurance, 7.4% of HF enrollees experienced foregone care in their second year of enrollment. This is similar to rates of unmet need in other studies.[28,38] Other factors besides lack of health insurance—having to take time off from work,[39] transportation barriers,[40] health literacy,[41] navigation skills,[42] health beliefs,[43] negative expectation of the healthcare system[44-46]—may be at play here. Because foregone care is associated with such large decrements in HRQOL, more attention should be paid to policies and interventions to overcome barriers to needed care, even among the insured.

Third, although this study concerned California's SCHIP program, it is thought to be generalizable to other states. Although SCHIP programs vary across states, this study suggests that the improvements in HRQOL came about via improving realized access to care. To the extent that various types of SCHIP programs (Medicaid expansions, separate SCHIP programs, combinations of the two) also

improve access to care, the relation to HRQOL found in California should hold elsewhere.

This study demonstrates that programs like SCHIP, which improve realized access to care, have a significant effect on children's HRQOL. Policymakers faced with the decision as to whether to reauthorize or expand SCHIP programs at both the Federal and State level should consider the effect of their decision on children's quality of life.

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Fifty Years Ago in *The Journal of Pediatrics*

Aminophylline (theophylline ethylenediamine) poisoning in children

White BH, Daeschner CW. J Pediatr 1956;49:262-71

White and Daeschner reported four cases of theophylline toxicity, two with seizures, and a summary of 16 previous reports in the literature. It was noteworthy because it brought to light iatrogenic theophylline toxicity in children. Many of the patients had been prescribed adult-size doses of rectal suppositories containing aminophylline. Subsequently, the use of suppositories declined and theophylline was mostly prescribed for children as a combination product containing ephedrine and a sedative (Marax, Tedral).

In 1975, synergistic toxicity between theophylline and ephedrine was demonstrated[1] and physicians subsequently switched to monotherapy with theophylline. As a result of the relationship between serum concentration, efficacy and toxicity,[2] and variable rates of metabolism,[3] it was common to individualize dosage based on serum concentration measurements.[4] Nevertheless, history was doomed to be repeated for those physicians who did not pay close attention to the complexity of theophylline dosing. With the widespread use of this drug as maintenance therapy for persistent asthma, particularly in slow-release dosage forms, reports of iatrogenic seizures, arrhythmias, and deaths from theophylline began to appear again in the literature.[5-7] In the years to follow, lawsuits against prescribers and product liability suits against manufacturers often resulted in juries awarding large sums of monies to plaintiffs.[8]

With the recognition of the importance of inflammation in the pathogenesis of asthma in the 1990s and the risk of toxicity from theophylline, inhaled corticosteroids rapidly replaced it as maintenance medication for persistent asthma. Now, 50 years after White and Daeschner's report was published, theophylline is rarely used in either children or adults and the issue of iatrogenic toxicity has essentially disappeared. Randomized, controlled trials indicate that theophylline still has a potential role in the intensive care unit treatment of acute asthma in children[9] and in addition to inhaled corticosteroids in severe persistent asthma.[10] However, the complexity of dosing this drug and its infrequent use suggest that most pediatric residents will not gain sufficient experience to use theophylline safely.

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